

SCIENCE

NEW YORK, MARCH 13, 1891.

INSTRUCTION OF THE DEAF.¹

THE essential difference between the oral and manual systems as methods of instruction lies in this: that with the former, articulate speech is developed, and made the chief means of communication between teacher and pupil; while with the latter, as applied in this institution, writing, spelling, and signs are developed, and made to perform the same office. Mental development and the acquisition of knowledge are the great end and aim of both systems. Intellectual development is the one prime necessity of all deaf-mute instruction, and, whatever the system pursued may be, this grand aim and object of all effort should be constantly kept in view. Of what possible use would be the power of speech with no thoughts to utter; of what avail writing or spelling with no ideas to express? The means of instruction must not be mistaken for the end: the structure reared is of vastly greater importance than the mere implements by which the work has been accomplished. Whether our pupils be instructed orally or manually, our great purpose is to make them rational, thinking beings.

In favor of the oral system, it cannot be maintained that vocal utterance is essential to the operation of the mental faculties, or that it is absolutely necessary for purposes of social intercourse, for it is well known that these ends, so indispensable to intelligent and rational existence, may be attained by other methods; nor can it be maintained for it as a system of instruction that it is superior to other systems as a means of mental development, or as an aid to the acquisition of language, although in the latter instance it certainly does possess some advantages not generally appreciated by the adherents of opposing systems.

The oral system rests its claims to superiority upon quite different grounds. Speech is a more general and more available form of communication than writing, spelling, or signing. The great hearing world, of which the deaf must ever form a very small part, speaks and understands spoken language; but too often it is unable to write, and almost always is unable to spell on the fingers or to sign. Speech, therefore, brings the deaf man who may be so fortunate as to possess it into closer relations with his hearing fellows, and affords him a wider field for the play of his ambition and for the exercise of his social instincts. Speech is the mental coin of the world. Stamped in it, the thoughts, hopes, and loves of the deaf pass current, unaffected by the existence of their physical infirmity, and without discount on account of their misfortune. It makes the whole world kin, it satisfies the innumerable daily experiences of social and business life, it meets more fully than any other form of human communication the demands of human affection. What wonder that parents thrill with delight as they catch the first feeble whisperings of speech from the lips of their deaf children! What wonder that fathers and mothers constantly ask, "May my child be taught to speak?" Surely no labor, no study, no unremitting exercise of care and attention, can

¹ From the Annual Report of the Board of Directors of the Pennsylvania Institution for the Deaf and Dumb, for the Year 1889-90.

be weighed in the balance with the immense benefit and consolation which speech affords to the child bereft of its hearing.

In sympathy with these views, it has been the policy of this institution for some time to provide separate oral instruction for those of its pupils who may profitably be instructed by that method. The wisdom of this policy is becoming more and more apparent in the excellent results attained, and it is only a question of time when a larger proportion of our pupils than we are now able to reach shall receive the benefit of this form of instruction.

On the other hand, for those pupils who cannot be satisfactorily instructed under the oral system, the board with equal wisdom as assiduously and carefully provides the most approved methods of manual instruction. In these features of its system of instruction, the Pennsylvania Institution enjoys a most signal advantage over any other school for the deaf in existence.

In a school in which oral instruction is alone provided, a large percentage of the pupils must derive but very little benefit; so, also, in a pure manual or combined school, a large number who might be orally taught have no adequate opportunity to acquire speech and speech-reading. In maintaining the two systems side by side in friendly rivalry as to which may most excel, it is believed that this institution, in the fulfilment of its high mission, provides every possible advantage for the instruction and advancement of its pupils: it offers speech to those who can acquire it; language, knowledge, intellectual growth, to all.

In securing the mental development of the deaf, natural signs may, without doubt, be made to perform a most important function. Their value, however, is sometimes overestimated, and their usefulness abused. Their best use, except for purposes of illustration and discipline, is found to be in the lecture-room, where are gathered together a large number of pupils for moral and religious instruction. In the classroom they should be sparingly used at all times, certainly never when written or spelled language may be used instead.

There is much diversity of opinion as to the limitations and restrictions that should be observed in the use of the language of signs. It is insisted upon by some that they should be limited to the same office and function they perform in the case of the acquisition of language by the hearing child. The gestures and actions of the mother or nurse alone give meaning to uttered words. Joy, fear, approval, love, are read in the mother's face and actions with unmistakable certainty while the uttered sounds are being poured into the child's ears. Material objects, in the same way, are named when seen and handled; and each passing event is seized upon and made to perform an important office in impressing upon the child's memory the meaning of words and sentences.

In this way, through the agency of natural signs and gestures, the hearing child acquires speech; and in this way and to a like extent some of our most successful manual and oral teachers of the deaf employ the sign-language, and, as in the case of the hearing child, as soon as verbal forms have been acquired, they seek to discontinue their use.

Others, again, place a much higher and more extended value upon their effectiveness as a means of development, and, instead of employing their time to perfect their pupils in the knowledge and use of that language which alone can introduce them to the world of thought and information, exert themselves to extend their acquaintance with natural and methodical signs, and to make them masters of pantomimic action. This to me is a most reprehensible practice and a complete perversion of the true use of signs in the instruction of the deaf.

Concerning the use of signs, Mr. Luzerne Rae says, "A too abundant and constant use of signs is the grand practical error of American institutions for the deaf and dumb."

Dr. E. M. Gallaudet, president of the National Deaf-Mute College, in an able article in the *American Annals*, maintains that "until a deaf-mute can think freely in conventional language, and express his thoughts fluently and correctly in the same, every instance of the use by him or to him of the language of signs in its natural order, impedes his progress toward the great end and object of his education."

In the oral instruction of the deaf, except in the earlier stages, signs as a means of communication should be carefully prohibited; in manual instruction they should be used as sparingly as possible at all stages. If the deaf are to satisfactorily acquire speech and speech-reading, they must early learn to rely upon them for all purposes of communication; and if they are to acquire fluency and correctness in the written forms of the language, they must be required constantly to express their ideas in the same. The continued general use of signs will in either case prove highly detrimental to the great end and object of instruction, and no intelligent teacher will prolong their exercise one moment after they have served their legitimate purpose. Like the scaffolding used in the erection of a building, which, however helpful and necessary during the course of construction, having served its purpose, is cast aside, with the completion of the edifice, as something not only unnecessary to the strength and duration of the structure, but as something, which, if permitted to stand, would prove a most serious debasement of its beauty and utility, so signs, however rapid and convenient and helpful they may be as means of communication and mental development, in the various stages of intellectual growth, having served their purpose, should be rigidly cast aside as debasing and detrimental to that newer and more perfect language which it is their proper function to aid in attaining.

A. L. E. CROUTER.

TEMPERATURE IN THE GLACIAL EPOCH.¹

THE late long frost has naturally suggested the question, "What permanent fall of temperature would produce a recurrence of the glacial epoch?" It is a question not easily answered, for it is like a problem complicated by too many independent variables. It is not enough for us to ascertain the actual temperature of a district in order to determine whether it will be permanently occupied by snow and ice. There are regions where the ground, a short distance below the surface, is always frozen to a depth of several yards at least; and yet glaciers do not occur, even among the hills, because the amount of precipitation is so small that the summer rapidly dissipates what the winter has collected. There are other regions partly covered by ice, though their mean annual temperature is distinctly above the freezing-point; as where glaciers descend to the sea from hilly districts, of which a considerable area lies above the snow-line, and on which there is much precipitation. In the case of Great Britain, at least, a further

difficulty enters into the problem; namely, that much controversy still prevails as to the interpretation of the symbols upon which our inferences in regard to the temperature of these islands during the glacial epoch must depend. Some authorities would concede no more than that the highland districts of Scotland, Wales, and England were enveloped in snow and ice, and the glaciers, whether confluent or not, extended from their feet for a few leagues over the lowlands, say, to some part of the coast of Lancashire and of Northumberland; while others desire to envelop a large part of the British Isles in one vast winding-sheet of ice, a corner of which even rested on the brow of Muswell Hill, above the valley of the Thames. The one school regards the boulder clay of England as a deposit mainly submarine, the product of coast-ice and floating ice in various forms: the other attributes it exclusively, or almost exclusively, to the action of land-ice. Into this thorny question we do not propose to enter. The approximation which we shall attempt—and it can only be a rough one—can be easily modified to suit the requirements of either party.

We will assume throughout that the annual isothermal of 32° coincides with the line of permanent snow. This, obviously, is an assumption. Often, owing to small precipitation, it will be found to be erroneous; but we take it as the only simple approximation, for, under favorable circumstances, masses of ice may protrude beyond it.

The question, then, may be put in this form: "Assuming a sufficient amount of precipitation, what changes of temperature are required in order to bring within the isothermal of 32° regions which are generally admitted to have been occupied by land-ice during some part of the glacial epoch?"

First, in regard to the British Isles. All will admit that in many places the Cumbrian and Cambrian glaciers descended to the present sea-level. The mean temperature of the Thames valley near London is 50° F. This isotherm cuts the Welsh coast a little east of Bangor. Obviously, the whole region north of this line has a lower mean temperature; no part of the British Isles, however, being below 45°. Hence a general fall of 18° would give a temperature of 32°, at most, in the Thames valley and on the shores of North Wales (except on the extreme west), while on the coasts farther north the temperatures would range down to 27°. What would be the effect of this? Switzerland may enable us to return an answer. The snow-line in the Bernese Oberland may be placed roughly at 8,000 feet above the sea, but it is obvious that the chief feeding-ground of the Alpine glaciers lies rather higher up in the mountains. In the case of such glaciers as the Great Aletsch, or the Aar, the lowest gaps in their upper basins are rather above 10,000 feet; while the surrounding peaks range, roughly, from 12,000 to 14,000 feet, though but few exceed 13,000 feet. Thus the feeding-ground of the Oberland glaciers may be regarded as equivalent to a mountain district the sky-line of which ranges from rather above 2,000 to 5,000 feet. In reality, however, not very much of it exceeds 4,000 feet above the snow-line. This, indeed, rather overstates the case. We find practically that the effective feeding-ground, that which gives birth to glaciers, which protrude for some distance below their supply-basins, may be placed about 1,000 feet above the ordinary snow-line; so that the glacier-generating region of Switzerland may be regarded as equivalent to a mountain district with passes about 1,500 feet, and peaks not often exceeding 3,000 feet. It follows, then, that if the temperature at the seacoast in North Wales were 32°, the whole of the Scotch Highlands, and a large part of the Cumbrian and Cambrian Hills, would become effective feeding-grounds, and the glaciers would be able to descend into the plains. In the Alps, the larger glaciers terminate at present at altitudes of from 4,000 to 5,500 feet (approximately); that is, they descend on an average about 4,000 feet below the effective feeding-ground, or 3,000 feet below the snow-line. If the temperature of Bangor were not higher than 32°, then the Snowdonian district would be comparable with one of the Alpine regions where the mountains rise generally from about 1,000 to 3,000 feet above the snow-line; that is, with such a one as the head of the Maderanerthal, where none of the peaks reach 12,000 feet above the sea. Here the Hüfi Glacier leads to passes rather below 10,000, among peaks of about 11,000 feet in altitude, and it terminates a little above 5,000 feet;

¹ From Nature.

that is to say, a region, rising roughly from 2,000 to 3,000 feet above the snow-line, generates a glacier which descends more than 2,000 feet below it.

But what change is required to give a glacial epoch to Switzerland? It is generally agreed that an ice-sheet has enveloped the whole of the lowland region between the Alps and the Jura. Let us assume, that, other conditions remaining the same, this could occur if the mean annual temperature of this lowland were reduced to 32° . Its present mean temperature varies somewhat; for instance, it is 45.86° at St. Gall, 49.64° at Lausanne. Let us take 47.5° as an average, which is very nearly the mean temperature of Lucerne.¹ So this lowland requires a fall of 15.5° . We may take the average height of the region as 1,500 feet above the sea. If, then, we begin the effective gathering-ground at 1,000 feet higher, the valley of the Reuss from well below Wasen, and the valley of the Rhone from a little above Brieg, would be buried beneath *névé*: so that probably a fall of 16° would suffice to cover the lowland with an ice-sheet, and possibly bring its margin once more up to the Pierre-à-bot above Neuchâtel; at any rate, a fall of 18° would fully suffice, for then the mean temperature of Geneva would be slightly below 32° .

The line of 41° passes through Scandinavia a little north of Bergen. If, then, the climate of Norway were lowered by the same amount, which also is that suggested for Britain, the temperature at this part of the coast would be 23° , corresponding with the present temperature of Greenland rather south of Godhavn, and probably no part of Norway would then have a higher mean temperature than 26° .

The wants of North America are less rather than greater; though, as geologists affirm, an ice-sheet formerly buried all the region of the Great Lakes, and descended at one place some fifty leagues south of the 40th parallel of latitude. Its boundary was irregular; but, if we strike a rough average, it may be taken as approximately corresponding with the present isotherm of 50° . The temperatures, however, in North America fall rather rapidly as we proceed northwards. Montreal is very nearly on the isotherm of 45° , and this passes through the upper part of Lakes Huron and Michigan; that of 39° runs nearly through Quebec and across the middle of Superior; while at Port Arthur, on the same lake, the temperature is only 36.2° . If, then, we assume sufficient precipitation, the maximum fall of temperature required for this North American ice-sheet will be 18° ; but less would probably suffice, for the district north of the St. Lawrence would be a favorable gathering-ground. This would be brought within the isotherm of 32° by a fall of 12° , or, at most, of 13° .

It seems, then, that if we assume the distribution of temperature in the northern hemisphere to have been nearly the same as at present, we require it to have been lowered, at any rate in the regions named, by about 18° , in order to bring back a glacial epoch. For North Wales a reduction of about 20° might be needed; but, if the isotherms ran more nearly east and west, 18° for the Thames valley might suffice. If we assume the great extension of glaciers in central and north-western Europe to be contemporaneous with that in America, we must suppose that these parts of the northern hemisphere had a climate more nearly resembling, but even colder than, that which now prevails in the southern hemisphere. The isotherm of 40° runs a little to the south of Cape Horn; that of 45° passes north of the Straits of Magellan. The latter lie on parallels of latitude corresponding with those of North Wales, but their mean temperature is about 8° lower. If we could restrict ourselves to the British Isles, it would be enough to assume a different distribution of temperature from that which now prevails on the globe, for at the present time, and in the northern hemisphere, the isotherm of 32° twice comes down very nearly to the latitude of London; but it may be doubted whether this alone would account for the great extension of the Alpine glaciers, and the difficulties seem yet greater in the case of North America. Here, where even at present the temperature is rather abnormally low, we have to make a very considerable reduction. But this is too wide a question to discuss at the end of an article

¹ St. Gall, 45.86° F.; Berne, 46.58° ; Lucerne, 47.48° ; Zurich, 48.20° ; Neuchâtel, 48.74° ; Geneva, 49.46° ; Lausanne, 49.64° . St. Gall and Berne are rather high stations, the one being 2,165 feet, the other 1,760 feet. The lake of Lucerne is 1,487 feet above the sea.

in these pages. We seem, however, fairly warranted in concluding that, whatever may have been the cause, a lowering of temperature amounting to 18° , if only the other conditions either remained constant or became more favorable to the accumulation of snow and ice, would suffice to give us back the glacial epoch.

T. G. BONNEY.

A NEW DEPARTURE IN DEAF-MUTE EDUCATION.¹

THE attention of instructors of the deaf and their friends has in various ways within the past few months been called to a proposal, very briefly outlined in the annual report of the Columbia Institution, for the enlargement of the facilities for normal training already existing in this college.

Misapprehensions have naturally arisen as to what was proposed, because, in the absence of any official utterance, unauthorized persons have taken it on themselves to publish conclusions based purely on presumptions, or, in some instances, on incomplete statements and perverted inferences.

As the plans of our directors for the "new departure" are now measurably complete, final action having been only reached in a meeting of the board held this day, I take pleasure in announcing that the teaching force of our institution will be increased next year by the employment of an experienced instructor in articulation, who will be especially devoted to the promotion of speech and lip-reading in the college.

Liberal provision has recently been made for this object by Congress.

The directors have to-day established six normal fellowships, of the value of five hundred dollars each per annum, to which graduates of colleges will be appointed for one year. These fellows will be required to reside in the institution, and will receive instruction in both the manual and the oral methods of teaching the deaf. They will, in view of the advantages to inure to them from these fellowships, be expected to perform certain duties in the institution, and will therefore constitute a distinct addition to its teaching force.

The funds for sustaining these fellowships are at the disposal of the board from sources other than the treasury of the United States.

The suggestion of establishing these fellowships, with a view of training instructors of the deaf of the highest grade, is taken from the arrangement existing in the Johns Hopkins University at Baltimore, from the ranks of whose fellows college professors, principals of high schools, and other instructors of high rank, are drawn in large and increasing numbers.

JOHNS HOPKINS UNIVERSITY,

BALTIMORE, MD., March 5, 1891.

Dr. E. M. GALLAUDET,

President National Deaf-Mute College.

Dear Sir,—I am very much interested in what you have told me of your plans and hopes for the development of the National Deaf-Mute College. Particularly it seems to me wise that you should give prominence to the fact that articulation is taught, by designating a competent instructor who should have a specific title indicating that he performs this service. I am even more interested in what you say of the possibility of enlisting annually half a dozen or more men in the service of the college, who would not only be valuable assistants during their residence with you, but would be trained for permanent careers in the various institutions of the land. Such a system here has been most fruitful in good results, and I can easily foresee how a carefully chosen staff of associates or fellows in the National Deaf-Mute College, holding an intermediate position between the permanent members of the faculty on the one hand, and the students on the other, would inspire the teachers, help the scholars, and furnish, in time, a corps of instructors for the schools for the deaf, which now exist in such considerable numbers throughout the country.

Yours sincerely,

D. C. GILMAN.

The above letter from President Gilman had much weight with our directors in their deliberations to-day.

¹ Circular of Information issued by the National Deaf-Mute College, Washington, D.C., March 7, 1891.

The advantages to the profession of deaf-mute instruction in this country, growing out of the normal fellowships now established, are many and obvious.

First of all, opportunities will be furnished to schools for the deaf to secure the services of young men and women possessed of all their faculties, of the highest education and character, with a knowledge of the natural language of the deaf, and capable of teaching by either the manual or the oral method, as circumstances may require.

These young teachers will have had not only good academic and collegiate training, but also, besides all they will gain at Kendall Green, at least a year's residence in Washington, where valuable opportunities are found for culture in the public libraries, museums, legislative halls, courts, and many other places where contact with men of high attainments is possible.

In our "new departure" the training of "deaf teachers of the deaf" will have its proper share of attention, but not that position of exaggerated importance to which it has been assigned by certain persons who have been self-appointed to speak for the college.

Those of our own students whom it may seem wise to encourage to become teachers will have all needed help in their laudable endeavor; and it is believed that the future will show, as the past has done, many of our graduates doing as good and as useful work in the instruction of their fellow deaf-mutes as can be accomplished by the best hearing and speaking instructors.

In closing this circular, the writer desires to say that the plans for increasing the usefulness of the college herein unfolded are precisely those that have been in his mind for many months, having suffered no modification by recent events.

It did not seem best to give them to the public until the ability to carry them into effect existed.

They are now communicated in the hope that they will be accorded the sympathy, the approval, and the co-operation of instructors of the deaf of all methods, of the deaf themselves, and of those friends of the cause of deaf-mute education who believe in trying to attain the greatest possible good for the greatest possible number.

EDWARD M. GALLAUDET,
President.

NOTES AND NEWS.

A PRESS despatch from Panama states that the United States Fish Commission steamer "Albatross" arrived at that port on Feb. 17, eighteen days from San Francisco *via* Acapulco. She went there to meet Professor Agassiz, who arrived from New York on the "Newport," and under his direction will make a scientific cruise in tropical waters. The area under investigation comprises the Gulf of Panama, the Galapagos, and thence to Acapulco.

— An interesting paper on the destruction of wolves in France appears in the current number of the *Revue Scientifique*, says *Nature* of Feb. 12. The law in virtue of which rewards are given for the killing of wolves was passed on Aug. 3, 1882, and during the last four months of that year 423 were destroyed. In 1883 the number killed was 1,316, the sum paid in rewards being 104,450 francs. The number was 1,035 in 1884, 900 in 1885, 760 in 1886, 701 in 1887, 505 in 1888, 515 in 1889. The departments in which most animals have been slain are Dordogne and Charente. It is believed that very soon no specimens will be left in France except those which occasionally reach it from neighboring countries.

— During the present season, according to *Nature* (Feb. 19), an attempt is to be made to extend our knowledge of the wild tribes inhabiting the borderland of Burmah, between Bhamo and the Chinese frontier on the one hand, and between the Northern Shan States and the Chinese frontier on the other. Lieut. Daly, superintendent of the Northern Shan States, and Lieut. Elliott, assistant commissioner, will spend the greater part of the next six months exploring these regions. The former will have with him an escort of fifty men of the military police, and will be accompanied by Mr. Warry of the Chinese Consular Service, and Lieut. Renny

Tailyour of the Survey Department. He starts from Lashio, and will visit the states on the Salween, including the important state of Kyaingyanyi, and will then return along the supposed Chinese border, ascertaining its situation as accepted on the spot, and the nature of the country and the tribes inhabiting it. Mr. Elliott will start from Bhamo, and will be accompanied by Major Hobday of the Survey Department. These officers also will be supplied with an escort of military police. They will probably proceed up the right bank of the Irrawaddy to the bifurcation of the river, and then will cross and examine the country on the Chinese border on the left bank. The country is practically unknown at present, and it is expected that much information of an interesting nature will be collected by the exploring parties. The explorers will, of course, confine their attention to the British side of the border, and, when the time comes for the formal demarcation of the frontier by a joint commission of Chinese and British officials, the information now to be collected will, no doubt, prove useful.

— The *Journal of the Society of Arts* (London) states that the production of wine in France for the year 1890 amounted approximately to 27,416,000 hectolitres, or 603,000,000 gallons, — a proportion of 330 gallons to each hectare of land (a hectare is equivalent to 2.47 acres) under vine-cultivation. This shows an increase of 92,000,000 gallons over 1889, and a falling-off of 50,000,000, when compared with the average production of the last ten years. The increase is observable in 45 departments. *Per contra*, a falling-off was noticed in 31 departments. Viticulturists appear to have employed, as compared with 1889, much larger quantities of low-class sugars to improve the quality of their products, or to increase the yield. The quantity of wine declared for sweetening, which amounted in the first ten months to 19,561,618 kilograms, exceeded, in the period ending Oct. 31, 1890, 32,000,000 kilograms. It was necessary, as usual, to have recourse to large importations of foreign wines. During the first eleven months of last year, the quantity purchased from abroad amounted to 219,000,000 gallons. Spanish wines figured in the list to the extent of 150,000,000 gallons; Italian, 396,000; Portuguese, 4,180,000; Algerian, 38,000,000; and Tunisian, 198,404. In Algeria, wine-cultivation continues to make progress. The area under vines has increased by 3,699 hectares, in 1890; and the yield amounted to 62,568,000 gallons in that year, as compared with 55,264,000 gallons in 1889. As regards cider, the yield in France, in 1890, exceeded that of 1889 by 162,000,000 gallons, and only falls short of the average production of the last ten years by 24,000,000 gallons. In Brittany and Picardy the yield was generally greater than that of an average year; in Normandy it was not so good, and the same remark applies to Mayenne and La Sarthe.

— Among the appropriations made by the Sundry Civil Bill passed at the close of the last session of Congress are the items, aggregating \$430,000, for the purchase of the Butler and Richard buildings for the use of the United States Coast and Geodetic Survey of the Treasury Department. The survey has occupied the latter building as an office since its erection in 1872, also one tenement (of the three) of the Butler building; but the increased demand for charts has rendered it necessary to greatly enlarge its printing-plant by the addition of more presses, etc. The triangulation, astronomical, magnetic, gravity, levelling, tidal, and sounding records, and the original maps of the survey, form a very valuable collection, both for reference and for comparative study. These have been steadily accumulating until they have reached such a magnitude that it has been almost impossible to handle the current work of the office. The Weights and Measures Office is also included in this bureau, and, as science advances, the demand for increased accuracy keeps pace with it; and this office is called upon to verify for colleges, manufacturing firms, and many other business institutions, as well as for the government bureaus and the several States, weights and measures of many and diverse descriptions. The question of space has long been a serious drawback and hindrance to the ready prosecution of the work intrusted to it. The bureau has reason to be congratulated upon the acquisition of a home which belongs to the government, and not being longer dependent upon landlords for keeping in repair even the roof over its head. The property ac-

quired by the government by this purchase lies directly south of the Capitol grounds, on the brow of the hill, and is not only valuable now, but is likely to increase rapidly, both on account of its commanding position and its proximity to the Capitol.

— If the statements in a communication to the Académie des Sciences by M. Lippmann are substantiated, another step towards the solution of the problem of photographing objects in their natural colors has been made. M. Lippmann's method is remarkably simple, and makes use of the ordinary re-agents. The sensitive film during exposure, as stated in *Engineering* of Feb. 20, is floated on the surface of mercury. Suppose, now, a ray of blue light, for instance, strikes the sensitive film: it will pass through, and, being reflected from the surface of the mercury behind, will pass out through the film again, interfering on its way with the incident ray. When the two rays are in the same phase, their effects will be additive, and the sensitive matter in the film will be strongly acted on. At a small distance further on, the two rays will neutralize each other, so that the film is there totally unacted on. In this way the thickness of the film is divided up into layers, on which the light has acted, half a wave-length apart; and hence, when fixed and dried, it may be considered as consisting of a number of thin plates, of the half the wave-length of blue light in thickness, and will therefore give rise to a blue color when seen by reflected light, just as the thickness of a soap-bubble gives rise to the colors seen in it. Such is a general sketch of the process as described by M. Lippmann, who adds, however, that the sensitive silver salt, iodide, bromide, or whatever else may be used, must be distributed throughout the film in an almost infinitely divided state, and in a perfectly continuous manner. The film itself must be transparent. Owing to the fact that the thickness of an ordinary film is many times the wave-length of a ray of light, the colors obtained are said to be remarkably brilliant. They are, moreover, perfectly fixed; and the prints have been exposed both to a powerful electric arc light and to bright daylight without any signs of fading. It should be added, that, if the prints are viewed by transmitted in place of by reflected light, each color is replaced by its complementary one.

— The following details regarding the work reported by the United States Hydrographic Office will be of interest: The dangerous obstructions to navigation off Barnegat caused by the wrecks of the Spanish steamship "Vizcaya" and the American schooner "Cornelius Hargraves" were removed by the United States steamship "Yantic" (Commander C. H. Rockwell, U.S.N., commanding) on Jan. 29. There were thirteen fathoms of water over the steamer, which lay on her beam ends. Her two iron masts and one of the wooden ones were broken off close to the deck; the fourth (wooden) was afloat, with the heel about ten feet above water, and head held down by the rigging. The "Hargraves" was found to be nearly upright. Of her four large masts, the fore was standing erect, the topmast fiddled and secured with massive wire rigging. The second mast was broken off near the deck, and was floating with the lower part above water, and surrounded by a mass of floating wreckage attached by rigging. The third mast was also intact, like the first, and connected with the hull by the rigging. The fourth was not visible. The massive wire rigging was first cut from the mastheads and towed clear of the hull, so as not to interfere with lowering the torpedoes. This duty was performed by a party under the direction of Lieut. Richman, assisted by Lieuts. Mertz and Rose, Ensign Bristol, and Boatswain Sutton. The work was successfully accomplished, after some delay on account of thick fog. Torpedoes were carried out, attached to mast-hoops on the mast of the "Hargraves," sunk to a depth of twelve and a half fathoms, so as to rest on her deck, and exploded. The mast was broken off close to the deck, and came to the surface, with a portion of the deck-house or cabin. In a similar way the other masts of the schooner and steamer were attacked and blown out, and on the morning of the 30th the work was so far completed that careful soundings taken in the vicinity showed nowhere a depth of less than thirteen fathoms, with no obstruction visible. The "Yantic" received orders on Feb. 10 to cruise along the coast from

Sandy Hook to Charleston, S.C., and to destroy, as far as practicable, all abandoned wrecks dangerous to navigation.

— Between electricity, which turns night into day, and in other ways fulfils the duty of a city full of policemen, and photography, which disseminates the features of the convict far and wide, the times are not so auspicious for the burglar as they used to be. A citizen of Toledo, O., is accredited by the *Boston Transcript* with an invention by which an instantaneous photograph of an incoming burglar can be made by the flash-light camera that has been previously set and focused toward the door in such a way as to take in the entire figure of the intruder. The essential features of the device are a camera and a flash-light arrangement, in which is provided mechanism to strike a match, that ignites the flash-powder. Simultaneously with the flash a pivoted spring shutter is moved so as to cause instant exposure on the sensitive plate, and the work is done. As the burglar opens the door and steps on a prepared mat, an electrical connection is made, and a lively greeting rings out from the alarm-bells. The burglar may retreat as hastily as he pleases, but the photo flash-light has been too quick for him, and his image is left behind.

— From the official report of the Japanese census, taken on Dec. 1, 1889, it appears that the number of houses in the whole of Japan is 7,840,872, and the total population 40,702,020. The above population divided according to classes gives the following results, as we learn from *Nature* of Feb. 19: nobles and their families, 3,825; old military class, 1,993,637; common people, 38,074,558. These figures, compared with the census taken in 1888, show an increase of 38,046 houses, and of 464,786 persons. Statistics of ages are also given; and from them it appears that at the close of 1889 there were 65 persons who had attained their hundredth year in Japan, 45 their hundred and first year, 13 their hundred and second year, 11 their hundred and third year, 1 his hundred and fourth year, 9 their hundred and fifth year, 3 their hundred and sixth year, 1 his hundred and seventh year, and 1 his hundred and ninth year. The cities and prefectures having populations of over a million numbered 15, that of Tokio being given at 1,138,546; but this includes not only the city, but also a considerable administrative area around.

— D. C. Heath & Co., Boston, have just published a map of Palestine, prepared in outline especially for the use of Sunday-school teachers and classes. The same firm have in press for early publication, in their Modern Language Series, an edition of Eichendorff's "Taugenichts," with notes by Professor Osthaus of Indiana State University; also a volume containing "La Derniere Classe," "La Siege de Berlin," and "La Mule de Pape," — three ingenious stories from the pen of that clever writer, Alphonse Daudet, with notes by Professor Sanderson of Harvard.

— The Milton Bradley Company of Springfield, Mass., have recently published a manual for teachers which is of more than ordinary importance. It is entitled "Color in the School-Room," and, besides a hundred pages devoted to the theory and practice of color-teaching, it contains nearly the same number of pages of colored papers prepared for primary instruction. The selection of colors given includes the six spectrum standards, with intermediate hues between each two standards, and a miscellaneous selection of the tints and shades of the standards and various combinations of them. Each tint, shade, or combination is given a name corresponding with its color-value; as, for instance, "red tint No. 1," "red shade No. 2," "yellow-green shade," etc. This method, though it will not supersede the one in common use, is doubtless the best that can be devised for the purpose intended, as it gives a compact system of nomenclature well adapted to the needs of both teacher and pupil, each name at once suggesting its proper place in the color scheme. In the text there are chapters on the necessity of color-teaching in primary schools, color definitions, color-blindness (which, in some instances, is only color ignorance), the theory of light and color, a standard of color, how to utilize the spectrum as a standard of color, the use of rotating color-disks, the demand for a definite color nomenclature, the proper combination of colors, the Bradley scheme of colored papers, colored paper in the school-room, and water-colors in the school-room.

SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES

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SCIENCE IN NEW ZEALAND.¹

WHEN I rashly replied in the affirmative to the cablegram which I received from our secretary in Melbourne, asking me to undertake the honorable and responsible duties which I have to commence this evening, I fear I did not fully realize the difficulties of the position; but since then the sense of my unfitness for the task has become very oppressive. To address an assembly of this kind on general science must involve unusual difficulties, owing to the audience being largely composed of those who, only taking a casual interest in scientific discussions, look chiefly to the results; while, at the same time, there are present professional specialists in almost every branch of knowledge. I feel that on this occasion I must be ruled by the interest of the majority, and claim the forbearance of my fellow-workers in science if I have to refer in a sketchy way to subjects in which they are deeply interested, and far more learned than I profess to be.

Seeing that I am addressing a Christchurch audience, I hope I may be permitted, in the first place, to say a word concerning one whose scientific services should, without doubt, have obtained for him the position of first president in New Zealand of the Australasian Association. We naturally recall the name of Sir Julius von Haast on this occasion, and mourn for the loss the colony has sustained of one who for thirty years occupied a most prominent position. His early researches in the North Island, in company with Von Hochstetter, were followed by the exploration of the remote districts on the west coast of Nelson, after which Canterbury secured his distinguished services, and enabled him to leave that monument of his varied scientific knowledge, shrewd capacity, and indefatigable industry, which is to be found in the Canterbury Museum.

There are others of our fellow-colonists whose wide range of experience would have peculiarly fitted them to act as your president; and I am able to say, that, had our veteran colonist and explorer Sir George Grey felt more assured in health and strength, it would have been your pleasure this evening to listen to a flood of eloquence on all scientific topics that relate to the future development of Australasia. There is another name I feel must be mentioned as one who should have been in this position had his health permitted. I refer to the Rev. William Colenso, who is not only the greatest authority on the folk-lore of the Maoris, on whom he was among the first to confer a printed literature in their own language, but whose long-continued work as a field naturalist, and especially as a botanist, is exceedingly interesting,

seeing that it forms a connecting link that has continued the early spirit of natural-history research in New Zealand, that commenced with Banks and Solander, and was continued by Menzies, Lesson, the two Cunninghams, and Sir Joseph Hooker, prior to the arrival of colonists. Thus we still have in my esteemed friend, Mr. Colenso, an active veteran naturalist of what we may call the old school of explorers.

It is wonderful to reflect that little more than fifty years ago this European colony was represented by a few fishing hamlets on the seaboard of a country occupied by a considerable native population. To the early explorers, and even down to a much later date, the obstacles that beset their path were very different from those of the present time,—often obstructive natives, no roads, no steamers, no railways. Had an association then existed, and desired to promote science by giving our visitors an opportunity of visiting the remote parts of the islands, the same excursions which have on this occasion been planned to occupy a few days, would have occupied as many months, and then be accomplished only with great hardship and difficulty. I must ask the young and rising generation of colonial naturalists to bear this in mind when they have to criticise and add to the work of their predecessors. Such names of early colonists as Bidwill, Sinclair, Monro, Mantell, Travers, and many others, should ever be held in esteem as those who, amidst all the arduous trials of early colonization, never lost sight of their duty towards the advancement of science in New Zealand. I will not attempt to particularize other names from among our existing, and, though small in number, very active, corps of scientific workers. They are here, or should be, to speak for themselves in the sectional work; and I have no doubt some of those who did me the great honor of placing me in my present position are secretly congratulating themselves that they have secured for themselves the position of free lances on this occasion.

This is now the third annual gathering of this association, and New Zealand should feel honored that it has at so early a date in the association's history been selected to the turn in rotation as the place of meeting among so many divisions of the great colony of Australasia. The two volumes of the "Transactions" of the association, already in the hands of members, are quite sufficient to prove that the hopes of its founders—or, rather, I may almost say, the founder, Professor Liversidge of Sydney—have been amply fulfilled.

The papers read before the different sections, and the addresses delivered, have, in my opinion, to a most remarkable extent embodied information and discussions which were not likely to have been produced as the result of any of our local scientific organizations. The authors seemed to have felt it incumbent on them to place their subjects in the environment of Australasia, and not in relation to the colony they happened to represent. This, I take it, is the first truly effective step towards federation which has yet been achieved, and I trust that all our members will continue to be imbued with this spirit. Politicians should take this well to heart. Let them continue to aid all efforts that will tend to bring scientific accumulations in these colonies into a common store; so that each may discover for what purpose it has been best adapted by nature, and, by paying proper political respect in fiscal policy to one another, each may prosper to the full extent of its natural advantages. But it is not alone in the value of the papers communicated the association contributes to advance true civilization in the colonies. The face-to-face conference, the personal contact of the active workers in different lines of scientific work, must greatly facilitate the more thorough understanding of the work which has been done, and which is still undone. A vague idea, simmering in the brain of one scientist, who thinks light of it because it has no special application in his particular environment, may, by personal converse, flash into important results in the mind of another who has had the difficulties facing him, but without the happy thought occurring. It would be rather interesting for some one with leisure to endeavor to recount how many great discoveries have eventuated in this manner.

In casting my thoughts for a particular subject on which to address the association, I felt perplexed. Presidents of similar associations in the Old World, who are in constant contact with the actual

¹ Address of the president of the Australasian Association for the Advancement of Science, Christchurch, Jan. 16, 1891.

progress in scientific thought, feel that a mere recital of the achievements during their previous term is sufficient to command interest: but in the colonies most of us are cut off from personal converse with the leading minds by whom the scientific afflatus is communicated; and, in our suspense for the tardy arrival of the official publications of the societies, we have to feed our minds with science from periodical literature. But even in this respect my own current education is very defective, as I reside in the capital city of New Zealand, which has no college with a professional staff whose duty, pleasure, and interest it is to maintain themselves on a level with the different branches of knowledge they represent. I therefore decided, that, instead of endeavoring to review what had been done in the way of scientific progress, even in Australasia, it would be better to confine my remarks to New Zealand; the more so, that this is the first occasion that there has been a gathering of what must, to some extent, be considered to be an outside audience for the colony.

To endeavor to describe, even briefly, the progress made in the science of a new country, is, however, almost like writing its minute history. Every step in its reclamation from a wild state of nature has depended on the application of scientific knowledge, and the reason for the rapid advance made in these colonies is chiefly to be attributed to their having had the advantage of all modern resources ready to hand. As in most other matters in New Zealand, there is a sharp line dividing the progress into two distinct periods,—the first before, and the second after, the formation of the colony in 1840. With reference to the former period, it is not requisite that much should be said on this occasion. From the time of Capt. Cook's voyages, owing to his attractive narrative, New Zealand acquired intense interest for naturalists. His descriptions of the country and its productions, seeing that he only gathered them from a few places where he landed on the coast, are singularly accurate; but I think rather too much is sometimes endeavored to be proved from the negative evidence of his not having observed certain objects. As an instance, it has been asserted, that, if any of the many forms of the moa still survived, Capt. Cook must have been informed of the fact. Yet we find that he lay for weeks in Queen Charlotte Sound and in Dusky Sound, where all night long the cry of the kiwi must have been heard, just as now; and that he also obtained and took home mats and other articles of native manufacture, trimmed with kiwis' skins; and that most likely the mouse-colored quadruped which was seen at Dusky Sound by his men when clearing the bush was only a gray kiwi; and yet the discovery of this interesting bird was not made till forty years after Cook's visit. As a scientific geographer, Capt. Cook stands unrivalled, considering the appliances at his disposal. His longitudes of New Zealand are wonderfully accurate, especially those computed from what he called his "rated watches," the first type of the modern marine chronometer, which he was almost the first navigator to use. The result of a recent measurement of the meridian difference from Greenwich by magnetic signals is only two geographical miles east of Capt. Cook's longitude. He also observed the variation and dip of the magnetic needle; and from his record it would appear, that, during the hundred years which elapsed up to the time of the "Challenger's" visit, the south-seeking end of the needle has changed its position $2\frac{1}{2}^{\circ}$ westward, and inclines $1\frac{1}{2}^{\circ}$ more towards the south magnetic pole. Capt. Cook also recorded an interesting fact, which, so far as I am aware, has not been since repeated or verified in New Zealand. He found that the pendulum of his astronomical clock, the length of which had been adjusted to swing true seconds at Greenwich, lost at the rate of forty seconds daily at Ship Cove, in Queen Charlotte Sound. This is, I believe, an indication of a greater loss of the attraction of gravity than would occur in a corresponding north latitude.

The additions to our scientific knowledge of New Zealand, acquired through the visits of the other exploring ships of early navigators, the settlement of sealers and whalers on the coast, and of pakeha Maoris in the interior, were all useful, but of too slight a character to require special mention. The greatest additions to science were made by the missionaries, who, in the work of spreading Christianity among the natives, had the services of able

and zealous men, who mastered the native dialects, reduced them to a written language, collected and placed on record the traditional knowledge of the interesting Maori, and had among their numbers some industrious naturalists, who never lost an opportunity of collecting natural objects.

The history of how the country, under the mixed influences for good and for evil which prevailed almost without government control until 1840, gradually was ripened for the colonist, is familiar to all. The new era may be said to have begun with Dieffenbach, a naturalist who was employed by the New Zealand Company. He travelled, and obtained much information, but did not collect to any great extent, and, in fact, appears not to have anticipated that much remained to be discovered: for his conclusion is, that the smallness of the number of the species of animals and plants then known—about one-tenth of our present lists—was not due to want of acquaintance with the country, but to paucity of life forms. The chief scientific value of his published work is in the appendix, giving the first systematic list of the fauna and flora of the country, the former being compiled by the late Dr. Gray of the British Museum. The next great scientific work done for New Zealand was the admiralty survey of the coast-line, which is a perfect marvel of accurate topography, and one of the greatest boons the colony has received from the mother country. The enormous labor and expense which was incurred on this survey at an early date in the history of the colony is a substantial evidence of the confidence in its future development and commercial requirements which animated the home government.

On the visit of the Austrian exploring ship "Novara" to Auckland in 1859, Von Hochstetter was left behind, at the request of the government, to make a prolonged excursion to the North Island and in Nelson; and he it was who laid the foundation of our knowledge of the stratigraphical geology of New Zealand. Since then the work of scientific research has been chiefly the result of State surveys, aided materially by the zeal of members of the New Zealand Institute, and of late years by an increasing band of young students, who are fast coming to the front under the careful science training that is afforded by our university colleges.

In the epoch of their development, the Australasian colonies have been singularly fortunate. The period that applies to New Zealand is contemporaneous with the reign of her Majesty, which has been signalized by enormous strides in science. It has been a period of gathering into working form immense stores of previously acquired observation and experiment, and of an escape of the scientific mind from the trammels of superstition and hazy speculation regarding what may be termed common things. Laborious work had been done, and many grand generalizations had been formerly arrived at in physical science; but still, in the work of bringing things to the test of actual experiment, investigators were still bound by imperfect and feeble hypotheses and supposed natural barriers among the sciences. But science is one and indivisible; and its subdivisions, such as physics, chemistry, biology, are only matters of convenience for study. The methods are the same in all, and their common object is the discovery of the great laws of order under which this universe has been evoked by the great supreme Power.

The great fundamental advance during the last fifty years has been the achievement of far-reaching generalizations, which have provided the scientific worker with powerful weapons of research. Thus the modern "atomic theory," with its new and clearer conceptions of the intimate nature of the elements and their compounds that constitute the earth and all that it supports, has given rise to a new chemistry, in which the synthetical or building-up method of proof is already working marvels in its application to manufactures. It is, moreover, creating a growing belief that all matter is one, and reviving the old idea that the inorganic elementary units are merely centres of motion specialized in a homogeneous medium; and that these units have been continued on through time, but with such individual variations as give rise to derivative groups, just as we find has been the case in the field of organic creations. The idea embodied in this speculation likens the molecule to the vortex ring which Helmholtz found

must continue to exist forever, if in a perfect fluid free from all friction they are once generated, as a result of impacting motion.

There is something very attractive in the simplicity of this theory of the constitution of matter which has been advocated by Sir William Thomson. He illustrates it by likening the form of atoms to smoke-rings in the atmosphere, which, were they only formed under circumstances such as above described, must continue to move without changing form, distinguished only from the surrounding medium by their motion. As long as the original conditions of the liquid exist, they must continue to revolve. Nothing can separate, divide, or destroy them; and no new units can be formed in the liquid without a fresh application of creative impact.

The doctrine of the conservation of energy is a second powerful instrument of research that has developed within our own times. How it has cleared away all the old cobwebs that formerly incrustated our ideas about the simplest agencies that are at work around us! How it has so simplified the teaching of the laws that order the conversion of internal motions of bodies into phases which represent light, heat, electricity, is abundantly proved by the facility with which the mechanicians are every day snatching the protean forms of energy for the service of man with increasing economy. These great strides which have been made in physical science have not as yet incited much original work in this colony. But, now that physical laboratories are established in some degree at the various college centres, we will be expected, ere long, to contribute our mite to the vast store.

In practical works of physical research we miss in New Zealand the stimulus the sister colonies receive from their first-class observatories, supplied with all the most modern instruments of research, wielded by such distinguished astronomers as Ellery, Russell, and Todd, whose discoveries secure renown for their separate colonies. I am quite prepared to admit that the reduplication of observatories in about the same latitude, merely for the study of the heavenly bodies, would be rather a matter of scientific luxury. The few degrees of additional elevation of the south polar region which would be gained by an observatory situated even in the extreme south of New Zealand could hardly be expected to disclose phenomena that would escape the vigilance of the Melbourne Observatory. But star-gazing is only one branch of the routine work of an observatory. It is true that we have a moderate but efficient observatory establishment in New Zealand, sufficient for distributing correct mean time, and that our meridian distance from Greenwich has been satisfactorily determined by telegraph; also, thanks to the energy and skill of the Survey Department, despite most formidable natural obstructions, the major triangulation and meridian circuits have established the basis of our land-survey maps on a satisfactory footing, so that subdivisions of the land for settlement, and the adoption and blending of the excellent work done by the provincial governments of the colony, are being rapidly overtaken. Further, I have already recalled how much the colony is indebted to the mother country for the completeness and detail of the coastal and harbor charts, but there is much work that should be controlled by a physical observatory that is really urgently required. I may give a few illustrations. The tidal movements round the coast are still imperfectly ascertained, and the causes of their irregular variations can never be understood until we have a synchronous system of tide-meters, and a more widely extended series of deep-sea soundings. Excepting the "Challenger" soundings on the line of the Sydney cable, and a few casts taken by the United States ship "Enterprise," the depths of the ocean surrounding New Zealand has not been ascertained with that accuracy which many interesting problems in physical geography and geology demand. It is supposed to be the culmination of a great submarine plateau; but how far that plateau extends, connecting the southern islands towards the great Antarctic land, and how far to the eastward, is still an unsolved question. Then, again, the direction and intensity of the magnetic currents in and around New Zealand require further close investigation, which can only be controlled from an observatory.

Even in the matter of secular changes in the variation of the compass we find that the marine charts instruct that an allowance

of increased easterly variation of two minutes per annum must be made, and, as this has now accumulated since 1850, it involves a very sensible correction to be adopted by a shipmaster in making the land or standing along the coast; but we find from the recently published work of the "Challenger" that this tendency to change has for some time back ceased to affect the New Zealand area, and as the deduction appears only to have been founded on a single triplet observation of the dip taken at Wellington, and one azimuth observation taken off Cape Palliser, it would be well to have this fact verified. With regard to the local variation in the magnetic currents on land and close in shore, the requirement for exact survey is even more imperative. Capt. Creak, in his splendid essay, quotes the observations made by the late surveyor-general, Mr. J. T. Thomson, at the Bluff Hill, which indicate that a compass on the north side was deflected more than 9° to the west, while on the east side of the hill the deflection is 46° to the east of the average deviation in Foveaux Strait. He adds that if a similar island-like hill happened to occur on the coast, but submerged beneath the sea to a sufficient depth for navigation, serious accidents might take place; and he instances a case near Cossack, on the north coast of Australia, when H. M. Medea, sailing on a straight course in eight fathoms of water, experienced a compass deflection of 30° for the distance of a mile.

A glance at the variation entered on the meridian circuit maps of New Zealand shows that on land we have extraordinary differences between different trigonometrical stations at short distances apart. For instance: in our close vicinity, at Mount Pleasant, behind Godley Head lighthouse, at the entrance to Lyttelton harbor, the variation is only $9^\circ 3'$ east, or 6° less than the normal; while at Rolleston it is $15^\circ 33'$, and at Lake Coleridge $14^\circ 2'$. In Otago we have still greater differences recorded, for we find on Flagstaff Hill, which is an igneous formation, $14^\circ 34'$, while at Nenthorn, thirty miles to the north, in a schist formation, we find an entry of $35^\circ 41'$.

In view of the fact that attention has been recently directed to the marked effects on the direction and intensity of the terrestrial magnetic currents of great lines of fault along which movements have taken place, such as those which bring widely different geological formations into discordant contact, with the probable production of mineral veins, this subject of special magnetic surveys is deserving of being undertaken in New Zealand. In Japan and in the United States of America the results have already proved highly suggestive. A comparison between this country and Japan by such observations, especially if combined with systematic and synchronous records by modern seismographic instruments, would be of great service to the physical geologist.

There are many features in common, and many quite reversed, in the orographic and other physical features of these two countries. Both are formed by the crests of great earth-waves lying north-east and south-west, and parallel to, but distant from, continental areas; and both are traversed by great longitudinal faults and fissures, and each by one great transverse fault. Dr. Nauman, in a recent paper, alludes to this in Japan as the *Fossa Magna*; and it corresponds in position in relation to Japan with Cook Strait in relation to New Zealand. But the *Fossa Magna* of Japan has been filled up with volcanic products, and is the seat of the loftiest active volcano in Japan. In Cook Strait and its vicinity, as you are aware, there are no volcanic rocks; but there and southward, through the Kaikouras, evidence of fault movements on a larger scale is apparent. It would be most interesting to ascertain if the remarkable deviation from the normal, in direction and force of the magnetic currents, which are experienced in Japan, are also found in New Zealand: for it is evident, that, if they are in any way related to the strain of cross-fractures in the earth's crust, the observation would tend to eliminate the local influence of the volcanic rocks which are present in one case and absent in the other.

With reference to earthquakes also, few, if any, but very local shocks experienced in New Zealand have originated from any volcanic focus we are acquainted with, while a westerly propagation of the ordinary vibrations rarely passes the great fault that marks the line of active volcanic disturbance. In Japan, also, out of about 480 shocks which are felt each year in that country, each of

which, on an average, shakes about one thousand square miles, there are many that cannot be ascribed to volcanic origin.

There are many other problems of practical importance that can only be studied from the base-line of a properly equipped observatory. These will readily occur to physical students, who are better acquainted with the subject than I am. I can only express the hope that the improved circumstances of the colony will soon permit some steps to be taken. Already in this city, I understand, some funds have been subscribed. As an educational institution, to give practical application to our students in physical science, geodesy, and navigation, it would clearly have a specific value that would greatly benefit the colony.

Another great branch of physical science, chemistry, should be of intense interest to colonists in a new country. Much useful work has been done, though not by many workers. The chief application of this science has been naturally to promote the development of mineral wealth, to assist agriculture, and for the regulation of mercantile contracts. I cannot refrain from mentioning the name of William Skey, analyst to the Geological Survey, as the chemist whose researches during the last twenty-eight years have far surpassed any other in New Zealand. Outside his laborious official duties, he has found time to make about sixty original contributions to chemical science: such as his investigation into the electrical properties of metallic sulphides; the discovery of the fero-nickel alloy awaruite in the ultra-basic rocks of West Otago, which is highly interesting, as it is the first recognition of this meteoric-like iron as native to our planet; the discovery that the hydrocarbon in torbasic and the gas shales is chemically, and not merely mechanically, combined with the clay base; and his discovery of a remarkable color-test for the presence of magnesia and the isolation of the poisonous principle in many of our native shrubs. His recent discovery, that the fatty oils treated with aniline form alkaloids, also hints at an important new departure in organic chemistry. His suggestion of the hot air blow-pipe, and of the application of cyanide of potassium to the saving of gold, and many other practical applications of his chemical knowledge, are distinguished services to science, of which New Zealand should be proud.

In connection with the subject of chemistry, there is a point of vast importance to the future of the pastoral and agricultural interests of New Zealand, to which attention was directed some years ago by Mr. Pond of Auckland; that is, the rapid deterioration which the soil must be undergoing by the steady export of the constituents on which plant and animal life must depend for nourishment. He calculated that in 1883 the intrinsic value of the fixed nitrogen and phosphoric acid and potash sent out annually was £592,000, taking into account the wool and wheat alone. Now that we have to add to that the exported carcasses of beef and mutton, bones and all, the annual loss must be immensely greater. The proper cure would, of course, be to bring back return cargoes of artificial manure, but even then its application to most of our pastoral lands would be out of the question. I sincerely hope that the problem will be taken in hand by the Agricultural College at Lincoln as a matter deserving of practical study and investigation.

I have already referred to several great generalizations which have exercised a powerful influence in advancing science during the period I marked out for review; but so far as influencing the general current of thought, and almost entirely revolutionizing the prevalent notions of scientific workers in every department of knowledge, the most potent factor of the period has been the establishment of what has been termed "the doctrine of evolution." The simple conception of the relation of all created things by the bond of continuous inheritance has given life to the dead bones of an accumulated mass of observed facts, each valuable in itself, but as a whole breaking down by its own weight. Before this master-key was provided by the lucid instruction of Darwin and Wallace, it was beyond the power of the human mind to grasp and use in biological research the great wealth of minute anatomical and physiological details. The previous ideas of the independent creation of each species of animal and plant in a little Garden of Eden of its own must appear puerile and absurd to the young naturalists of the present day; but in my own college days

to have expressed any doubt on the subject would have involved a sure and certain pluck from the examiner. I remember well that I first obtained a copy of Darwin's "Origin of Species" in San Francisco, when on my way home from a three-years' sojourn among the red Indians in the Rocky Mountains. Having heard nothing of the controversies, I received the teaching with enthusiasm, and felt very much surprised, on returning to my *alma mater*, to find that I was treated as a heretic and a backslider. Nowadays it is difficult to realize what all the fuss and fierce controversy was about; and the rising school of naturalists have much cause for congratulation that they can start fair on a well-assured logical basis of thought, and steer clear of the many complicated and purely ideal systems which were formerly in vogue for explaining the intentions of the Creator, and for torturing the unfortunate students. The doctrine of evolution was the simple-minded acceptance of the invariability of cause and effect in the organic world, as in the inorganic; and to understand his subject in any branch of natural science, the learner has now only to apply himself to trace in minutest detail the successive steps in the development of the phenomena he desires to study.

With energetic leaders educated in such views, and who, after their arrival in the colony, felt less controversial restraint, it is not wonderful that natural history, and especially biology, should have attracted so many ardent workers, and that the results should have been so good. A rough test may be applied by comparing the number of species of animals and plants which had been described before the foundation of the colony, and those up to the present time. In 1840 Dr. Gray's list in Deffenbach's work gives the number of described species of animals as 594. The number now recognized and described is 5,498. The number of *Mammalia* has been doubled through the more accurate study of our seals, whales, and dolphins. Then the list of birds has been increased from 84 to 195, chiefly through the exertions of Sir Walter Buller, whose great standard work on our avifauna has gained credit and renown for the whole colony. The number of fishes and *Mollusca* has been much more than trebled, almost wholly by the indefatigable work of our secretary, Professor Hutton. But the greatest increase is in the group which Dr. Gray placed as *Annulosa*, which, chiefly through the discovery of new forms of insect-life, has risen from 156 in 1840, to 4,295, of which 2,000 are new beetles described by Capt. Broun of Auckland.

When we turn to botany, we find that Deffenbach, who appears to have carefully collected all the references to date in 1840, states that the flora comprised 632 plants of all kinds, and, as I have already mentioned, did not expect that many more would be found. But by the time of the publication of Hooker's "Flora of New Zealand" (1863), a work which has been of inestimable value to our colonists, we find the number of indigenous plants described had been increased to 2,456. Armed with the invaluable guidance afforded by Hooker's "Handbook," our colonial botanists have renewed the search, and have since then discovered 1,469 new species, so that our plant census at the present date gives a total of 3,355 species.

It would be impossible to make mention of all who have contributed to this result as collectors, and hardly even to indicate more than a few of those to whom science is indebted for the description of the plants. The literature of our post-Hookerian botany is scattered about in scientific periodical literature; and, as Hooker's "Handbook" is now quite out of print, it is obvious that, as the new discoveries constitute more than one-third of the total flora, it is most important that our young botanists should be fully equipped with all that has been ascertained by those who have preceded them. I am glad to be able to announce that such a work, in the form of a new edition of the "Handbook of the Flora of New Zealand," approved by Sir Joseph Hooker, is now in an advanced state of preparation by Professor Thomas Kirk, who has already distinguished himself as the author of our "Forest Flora." Mr. Kirk's long experience as a systematic botanist, and his personal knowledge of the flora of every part of the colony, acquired during the exercise of his duties as conservator of forests, point to him as the fitting man to undertake the task.

But quite apart from the work of increasing the local collections

which bear on biological studies, New Zealand stands out prominently in all discussions on the subject of geographical biology. It stands as a lone zoölogical area, minute in area, but on equal terms, as far as regards the antiquity and peculiar features of its fauna, with nearly all the larger continents in the aggregate. In consequence of this, many philosophical essays—such, for instance, as Hooker's introductory essay to the early folio edition of the "Flora;" the essays by Hutton, Travers, and others; and also the New Zealand references in Wallace's works—have all contributed essentially to the vital question of the causes which have brought about the distribution and geographical affinities of plants and animals, and have thus been of use in hastening the adoption of the doctrine of evolution.

Much still remains to be done. Both as regards its fauna and its flora, New Zealand has always been treated too much as a whole quantity; and in consequence percentage schedules, prepared for comparing with the fauna and flora of other areas, fail from this cause. It is absolutely necessary not only to discriminate localities, but also to study more carefully the relative abundance of individuals as well as of species before instituting comparisons. The facility and rapidity with which change is effected at the present time should put us against rashly accepting species which may have been accidental intruders, though wafted by natural causes, as belonging to the original endemic fauna or flora. Further close and extended study, especially of our marine fauna, is urgently required. We have little knowledge beyond the littoral zone, except when a great storm heaves up a gathering of nondescript or rare treasure from the deep. Of dredging we have had but little done, and only in shallow waters, with the exception of a few casts of the deep-sea trawl from the "Challenger." When funds permit, a zoölogical station for the study of the habits of our sea-fishes, and for the propagation of such introductions as the lobster and crab, would be advantageous. I observe that lately such an establishment has been placed on the Island of Mull, in Scotland, at a cost of £400, and that it is expected to be nearly self-supporting. With respect to food-fishes, and still more with respect to some terrestrial forms of life, we, in common with all the Australasian colonies, require a more scientific and a less casual system of acclimatization than we have had in the past.

One must talk with bated breath of the injuries that have been inflicted on these colonies by the rash disturbance of the balance of nature. Had our enthusiasm been properly controlled by foresight, our settlers would probably not have to grieve over the losses they now suffer through many insect-pests, through small birds and rabbits, and which they will in the future suffer through the vermin that are now being spread in all directions.

HEALTH MATTERS.

Why the Stomach does not digest Itself.

FROM a new study of this subject Dr. E. Sehrwald announces the following conclusions (*Medical Record*, March 7, 1891): 1. The balance between the alkali of the blood and the acid of the gastric juice does not follow, during life, the law of diffusion, but moves in narrower limits; 2. The self-digestion of the stomach is partly prevented by the alkalinity of the blood, and partly by cell-action; 3. The living epithelium interposed between the blood and the gastric juice prevents their mutual neutralization, and preserves the alkalinity of the blood and the acidity of the gastric juice; 4. By this protection the stomach is spared a great deal of work of secretion and absorption; 5. The protection furnished by the flowing blood is partly due to its alkalinity, and partly to its properties as a nutritive liquid; 6. All influences which arrest the nutrition of the cells of the walls of the stomach may lead to self-digestion and ulceration. The conditions which may be mentioned in this connection are, first, disturbances in the circulation; second, direct injury to the epithelium; and, third, injuries of the trophic nerves.

Cremation and its Safeguards.

The *Lancet*, Jan. 31, 1891, says, "Unfortunate circumstances connected with the death of the late Duke of Bedford have brought into prominence an important question respecting the

procedure of the Cremation Society, of which the late duke was a prominent member, in cases of death from other than purely natural causes. It is clear that in the case of the society absolute certainty as to the cause of death, when other than natural, can alone justify the preferential application of its method. It will therefore be interesting to examine the practical value of the safeguards adopted by the society to prevent the chances of fallacy in a matter so important. These are three: namely, (1) the certificate of the medical practitioner in attendance on the deceased during his last illness; (2) a second independent certificate by another practitioner after careful inquiry into the circumstances attending the illness; and (3), should any doubt remain, the evidence afforded by necropsy.

"A further, though possibly less permanent, security exists in the resolution of the society to refuse cremation in any case where the least doubt exists respecting the cause of death. Such doubt, as observed by Sir Henry Thompson, could remain after necropsy only in an extremely small number of cases, and would, in fact, be virtually abolished. Not actually so, however. There still remains a minimum uncertainty; and this, it is apparent, is much greater where certification, even on the very careful system employed by the society, is alone relied upon. The practitioner in attendance might, in spite of diligence and skill, be misled; for example, in a case where the signs of poison were obscurely blended with those of real or supposed disease. In this connection the case of the late Mr. Maybrick is suggestive. Is it, then, to be believed that a second medical testimony, which would be independent of the former, could be relied on to guarantee the difference of opinion which would necessitate an appeal to the coroner? We should rather expect that this latter evidence, divested as it must be of various technical premises which guided the statements in the first certificate, would be at best a carefully weighed and usually confirmatory assertion of moral certainty.

"After all, it is probable that the most reliable safeguard against a too precipitate practice of cremation which we possess is to be found in the resolutions of the society above mentioned. Cremation, therefore, under its present rules, is certainly a valuable means of promoting accuracy in certification. As affording an absolute guaranty of such accuracy, it cannot be depended on, while it must in all cases destroy every trace of morbid or mischievous agency contained in the tissues. While, therefore, we freely admit its practical security against any miscarriage of justice in the vast majority of cases, we cannot admit that it stands in this respect on a level exactly so high as the practice of burial. Moreover, while we also recognize its more absolute and destructive purity in the disposal of infectious dead, we do not see that it possesses any such advantage in comparison with burial in other cases, provided that burial be conducted, as it increasingly is conducted, on a rational or 'earth to earth' system."

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith. The editor will be glad to publish any queries consonant with the character of the journal. On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

The Motion of Storms and High Areas.

THERE was presented in this journal Feb. 27 a short discussion of the origin and motion of waves of heat and cold. I desire to still further discuss this question under an analogous heading. In the previous note it is possible that too much prominence was given to the occurrence of temperature falls in the rear of storms when there were no high areas near. These falls seem to be accompaniments of storms, but are of very limited extent and slight intensity. They seem to be due largely to radiation from the air and earth to the clear sky.

It may conduce to clearness if several propositions are advanced and discussed.

1. *Storms and High Areas have the Same Velocity.*—If this were not so, the one would overtake the other when they were moving along the same line. Of course, there may be such conditions, on any map, in different lines, which have widely different velocities.

2. *These Conditions extend far above our Highest Mountains.*—We find the fluctuations of air-pressure on the advance of these conditions the same at mountain stations as at the base, except that the changes occur later at the summit, for reasons which have been fully set forth in the "Report of the Chief Signal Officer for 1882." The temperature changes, both the rise on the advance of a storm and the fall in its rear, after the diurnal range has been eliminated, are greater on a mountain than at the base, and they occur several hours earlier at the summit. The form which a storm or high area assumes is that of a disk with a height of five to ten miles, and a diameter of one thousand, and it may extend to the limits of the atmosphere.

3. *There is no Marked Movement of Air or Moisture-Particles by Heated Currents from the Earth upward.*—The best proof of this, perhaps, is in the fact that the velocity of the horizontal currents is markedly increased as we rise in the atmosphere, and hence such a movement would be rapidly disintegrated and brought to nought.

4. *There is no Whirl in Either of These Conditions a Few Thousand Feet above the Earth.*—Observations on Mount Washington (6,800 feet) have shown this fact. Unfortunately we have not the data to show just how high the gyratory circulation which we observe at the earth's surface extends, but the limit is probably 3,000 feet. This fact is a most important one to determine, and there is no better region to establish it on the whole earth than the isolated mountain-peaks of New England. Greylock, Ascutney, Killington, Mount Washington, Green Mountain, and a score of others, are all situated right in the path of our storms and high areas, and, it is believed, are destined to aid most materially in solving the riddles which now confront us on all sides.

5. *Their Motion is Independent of the Wind.*—To those familiar with weather science this will be self-evident, but it may be well to simplify this proposition slightly. Let us consider the case of a storm condition moving at thirty miles per hour between two points (*A* and *B*) six hundred miles apart. Let the wind have a velocity of fifteen miles per hour. In twenty hours the exact changes of the wind, pressure, temperature, etc., which took place at *A* will take place at *B*, provided the storm remains constant; but if we had put in the wind at *A* a bit of cotton, or some substance which would go exactly with the wind, at the moment the storm-centre was at *A*, we would have found it just half way between *A* and *B* at the moment the storm-centre crossed *B*. This shows plainly that all the conditions which accompany a storm are practically independent of the wind. The wind blows cold, but it is because a cold wave has passed that way. This may be made still clearer by considering an enormous sphere a thousand or two thousand feet in diameter, and highly heated, at a few thousand feet above the earth. If this were stationary, our thermometers, if delicate enough, would show its pressure, and the wind would transport the heat at its velocity; though it is evident that there would be an exceedingly rapid dissipation of this heat if there were no method of renewal. Suppose this sphere were transported horizontally at thirty miles per hour, and its heat could affect our thermometers instantly: it is evident that there would be a miniature warm wave travelling across the country at thirty miles per hour; but this would be independent of the wind, though it would have a tendency to modify that.

6. *Their Motion is Independent of Air-Currents at any Elevation.*—This proposition will be the most difficult of all to accept, and yet it seems to be abundantly borne out by the facts. During the passage of a storm, the air-current gradually increases in velocity as we rise in the atmosphere. After a certain height is reached, the velocity of this current is diminished. Again, during the passage of a high area the velocity of the current itself is markedly diminished, and, as I have shown, it is half that of the high area at the height of Mount Washington, while during the passage of a storm it is nearly double the storm velocity. Now, it is plain that any condition having any height in the atmosphere would be entirely disintegrated by the varying velocity of the different strata of the atmosphere; and also its motion cannot be due to that of the strata, since this velocity is far greater than that of the storm, and is only half that of a high area. It has also been shown that the direction of motion of storms and high

areas is very different from that of the strata far above the earth. One other consideration may be presented. It frequently occurs that storm conditions seem to be transferred through the air without a corresponding depression at the earth's surface, and at a velocity which appears to be far higher than the air strata can have.

This whole subject is exceedingly complicated; and it must be confessed that we must continue to grope rather in the dark until we can obtain the facts which shall enable us to lay the first stone of a consistent theory of these conditions, which are so familiar to us, but of which we know next to nothing. I cannot do better than to close this discussion, without further comment, with the remarkable views of two specialists eminent in this line of research. These views are entirely at variance with the facts observed in this country, and cannot possibly be accepted as an explanation of the phenomena in question. I have already shown, that, owing to the peculiar position of European mountains far to the south-east of the path of storms, we can hope for but little assistance from observation at their summits in elucidating these complex problems.

Dr. J. Hann of Vienna, in a recent publication, has said, "The forces which are in activity in the winter in the air circulation of the higher latitudes arise from the heat of the tropics; that is, from the heat difference between the polar regions and the equatorial zone. Storms and high areas are merely secondary phenomena in the general atmospheric circulation."

Dr. W. Siemens of Berlin has written as follows: "Minima and maxima of air-pressure (storms and high areas) are consequences of the temperature and velocity of air currents in the higher atmospheric strata."

H. A. HAZEN.

Washington, March 9.

BOOK-REVIEWS.

Constructive Steam-Engineering. By J. M. WHITHAM. New York, Wiley. 8°. \$10.

THIS descriptive treatise covers pretty thoroughly a rather extensive field, embracing as it does engines, pumps, and boilers, with all their accessories and appendages. The scope of the work is limited, as indicated by the title, to constructive features, design not being discussed. But this does not lessen the value of the book; as nearly every form of engine or boiler that has won recognition in modern steam-engine practice is fully described, illustrated, and discussed. Steam-engine design, as a separate subject, was ably treated in a previous work by the same author, noticed in these columns a year or more ago.

In the preparation of this work the author has had ample resources to draw upon; and he has exercised notable discretion in sifting out essentials from non-essentials in dealing with the mass of material placed at his disposal by the current literature of the subject.

The plan of the work is as follows. A brief classification of the various types of engines comes first. This classification may be summed up as (1) condensing and non-condensing; (2) non-expansive and expansive; (3) simple, compound, triple-expansion, and quadruple-expansion; (4) single-acting, double-acting, and rotary; (5) rotative and reciprocating; (6) stationary, portable, locomotive, and marine. Less important is the further classification into (7) horizontal, vertical, inclined, and oscillating; and (8) erect vertical, inverted vertical, direct-acting, indirect-acting, and beam engines. Exception may be taken to the author's statement, in this introductory chapter, that compound, triple, and quadruple expansion engines have respectively two, three, and four cylinders. Some of them have, as shown in a subsequent chapter, at least one extra cylinder; that is, two low-pressure cylinders instead of one larger one. This, of course, is a small matter; but it would be well to classify the engine in this respect by the number of expansions instead of the number of cylinders.

The second chapter, a very important one, is devoted to heat and steam, embracing a discussion of thermometers and calorimeters. Then comes a chapter in which the constructive details of an engine are illustrated and discussed; after which comes a lucid presentation of the indicator and its uses, and a chapter on the

use, operation, and setting of the slide-valve and independent cut-off, followed by a discussion of the various forms of valve-gears, and of automatic cut-off and throttling engines. A chapter treating of compound and triple and quadruple expansion engines comes next, after which condensers, pumps, and pumping-engines are considered. Next is given a chapter on the miscellaneous attachments and minor details of an engine, embracing stop-valves, throttle-valves, and relief-valves, stuffing-boxes, belting, lubricators, etc., followed by a chapter on the management of engines and pumps, engine trials, and dynamometers.

When the subject of boilers is reached, a chapter is devoted to the theory of combustion and the various types of boilers in use, and another to their constructive details and strength. The concluding chapter of the book treats of the appendages and accessories of boilers, their decay, management, etc.

At first blush, after a hasty glance through the pages of this bulky volume, the price of it would seem too great; but, after a careful examination, that impression disappears. True, the material from which the author evolved the work was abundant and ready to hand, but the illustrations alone (and they are many) "came easy." The labor of working over the material, — putting it "into perspective," as it were, effectively, discriminatingly, and judiciously, — and welding the whole together into a book suitable alike to the needs of the student, the engineer, and the miscellaneous seeker for information, must have been enormous.

That the work is well done is certified to by the reputation of both author and publisher.

AMONG THE PUBLISHERS.

THE Forest and Stream Publishing Company announce a new and enlarged edition of "Fly-Fishing and Fly-Making for Trout," by J. Harrington Keene. The book has as illustrations actual specimens of the silk, feathers, and other materials used in fly-making.

— A "Flora of Palestine" is in progress, edited by the Rev. G. E. Post, and is now completed as far as the end of the order *Umbelliferae*. Several new species are described.

— Among the contents of the *New England Magazine* for March, we note "The Early History of Electricity in America," by George Herbert Stockbridge; "Window-Gardening," by Mrs. Henrietta L. T. Wolcott; "The Indian-Corn as our National Plant," by Sarah Freeman Clarke; "The Problem of the Unemployed," by William M. Salter; and "The History of Historical Writing in America," III., by J. F. Jameson, Ph.D.

— Messrs. Ginn & Co. announce "The Industrial Primary Arithmetic," by James Baldwin, Ph.D., to be published in April. This work possesses many features which distinguish it from others of its class. Theory gives place to practice. The pupils

Publications received at Editor's Office, Feb. 23-March 7.

- ALABAMA Geological Survey. Report on the Cahaba Coal Field, by Joseph Squire, M.E., with Appendix on the Geology of the Valley Regions Adjacent to the Cahaba Field, by Eugene A. Smith. Montgomery, Ala., State. 189 p. 8".
- AUSTEN, W. C. R. An Introduction to the Study of Metallurgy. London, Charles Griffin & Co.; Philadelphia, Lippincott. 292 p. 12".
- BALL, R. S. Time and Tide, A Romance of the Moon. New York, E. & J. B. Young. 188 p. 16". \$1.
- CARUS, P. The Soul of Man: An Investigation of the Facts of Physiological and Experimental Psychology. Chicago, Open Court Publ. Co. 458 p. 12". \$3.
- DARWIN, C. On the Structure and Distribution of Coral Reefs, with an Introduction by Joseph W. Williams. New York, A. Lovell & Co. 278 p., 12".
- DIETZ, W. D. The Soldier's First Aid Handbook. New York, Wiley. 93 p. 16". \$1.25.
- GAGE, A. P. Physical Laboratory Manual and Note Book. Boston, Ginn. 121 p. 12". 45 cents.
- GREEN, A. H. The Birth and Growth of Worlds. New York, E. & J. B. Young & Co. 61 p. 16". 40 cents.
- KINGS' Jester, The. Vol. I., No. 1. March, 1891. m. New York, Herbert Booth King & Brother. 16 p. 4". \$1 per year.
- LOCK, J. B. Arithmetic for Schools. American edition. London and New York, Macmillan. 338 p. 16". 70 cents.
- MERCURY, The. Vol. I., No. 1. w. Halifax, N. S., Dunn Publ. Co. 8 p. f°. \$2 per year.
- MORGAN, C. L. Animal Life and Intelligence. Boston, Ginn. 512 p. 8". \$4.
- PERRY, J. Spinning Tops. The "Operatives' Lecture" of the British Association Meeting at Leeds, 6th September, 1890. New York, E. & J. B. Young. 136 p. 16". \$1.
- TIDY, C. M. The Story of a Tinder-Box. New York, E. & J. B. Young & Co. 105 p. 16". 80 cents.
- U. S. NAVAL ACADEMY, Annapolis, Md., Annual Register of the, 1890-91. Washington, Government. 84 p. 8".
- WARD, H. M. Diseases of Plants. New York, E. & J. B. Young. 196 p. 16". \$1.

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—The *March Magazine of American History* opens with a study of the public career of Gen. Francis E. Spinner the financier, by Rev. Isaac S. Hartley, D.D. The paper includes a description of Gen. Spinner's part in the conception and issue of the "greenbacks." The second article is a story, by Hubert Howe Bancroft, of his varied experiences in bringing out his first book, describing his literary pilgrimage from California to visit the notable authors of Boston and New York. In the third paper we have a sketch, with portrait, of Rev. Samuel M. Isaacs, written by his son Abram S. Isaacs, Ph.D. Following this, Mr. A. W. Clason of Virginia contributes an account of the Pennsylvania Convention, 1788. The next is a paper from the pen of Hon. Charles K. Tuckerman of

Florence, Italy, entitled "An Hour with George Bancroft," in which he describes his last visit to the great historian; then comes a sonnet on the same theme, "George Bancroft, 1800-91," by William C. Richards. An article that will interest a large class of readers in all parts of the country is "Slavery in Canada," by J. C. Hamilton, LL.B. "The Homespun Age," a chapter by M. C. Williams, relates to early settlements in the interior valleys of Tennessee. "The Hunters of Kentucky," an old song, composed just after the battle of New Orleans, from W. Abbatt; the description of the frontispiece by the editor; and "Washington at Tarrytown in 1783," by M. D. Raymond,—complete the principal features of the issue.

—Under the title "Hints to Power Users," Mr. Robert Grimshaw, whose "Catechisms of the Steam Engine, Pump, and Boiler," and other practical works, have proved so popular, has prepared some non-technical advice to the men who pay the bills. It is issued by the Cassell Publishing Company, New York City.

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